is in this respect that Dr. Miquel claims superiority for his infinitely more laborious method of "ensemencements fractionnés" in bouillon. It is obvious that labour must be no consideration if any great scientific advantage is to be attained; but, on the other hand, the unnecessary complication of processes, without corresponding benefits, must invariably lead to the retardation of scientific progress. Now, it would certainly appear that the benefits obtained by Miquel's process are in no way commensurate with the additional labour which it entails. Thus, his process is also incapable of revealing all the microbes which may be present in water, and yields at best only a closer approximation to the total number than does the gelatine method. For the general purposes of the bacteriological examination of water, however, it is of very little consequence whether the method employed reveals, say, 30, 50, 70, or 90 per cent. of the total number of microbes present, all that is required being a result which will serve for comparison. Thus, supposing it is desired to ascertain the efficiency of some process of filtration, provided that the unfiltered and filtered waters respectively are submitted to the same method of examination, the comparative result will be the same whether 50 per cent. only or all the microbes present are in both cases enumerated. Thus putting this statement to the test of actual experiment, from the results of the gelatine-plate method of examination I reported to the Local Government Board in 1886 that the average reduction in the number of micro-organisms present in Thames water effected by the sand-filtration of the several London water companies amounted to—

98·6	per cent.	for the	Chelsea Company,
99·1	,,	,,	West Middlesex Company,
96·7	,,	,,	Southwark Company,
98·2	,,	,,	Grand Junction Company,
96·2	,,	,,	Lambeth Company,

whilst Dr. Miquel in 1890 gives as the effect of sand-filtration on the water of the River Loire a reduction of 99·3 per cent. in one case, and 99·4 per cent. in another case. A concordance more complete than this can certainly not be demanded. Similarly it can be shown that Dr. Miquel's method of water examination has not yielded any results of importance which had not already been arrived at before by other investigators using the more expeditious method of plate cultivation. It is indeed only for such differential experiments as that referred to above that the bacteriological examination of water, in the present state of our knowledge, is really of much value, for any judgment as to the purity or otherwise of a sample of water based upon the actual number of microbes found in a given volume of it, is liable to lead to the most serious errors, in consequence of the remarkable power which some bacteria possess of multiplying to an extraordinary extent in waters of the greatest organic purity; in fact, it is precisely in the purest waters that such multiplication is often most pronounced. It is the possibility of such multiplication taking place which renders it imperative that samples of water should be submitted to bacteriological examination within a few hours of their collection. In order to overcome this difficulty, which has hitherto debarred the examination of waters from distant sources, Dr. Miquel has the samples transmitted in a box surrounded with ice; to this there are manifold objections, for the low temperature thus secured by no means completely arrests the multiplication of some bacteria, whilst it causes the destruction of others. Dr. Georg Frank, of Berlin, on the other hand, seeks to overcome the difficulty by deputing to persons on the spot the task not only of collecting the samples, but also of preparing the plate-cultures; but, considering the nature of the instructions which he finds it necessary to give to the novices to whom this work may fall, the expedient does not appear very promising. The following is a verbatim extract from these instructions recently published in a German scientific journal of repute, which surely demands no comment:—

> "The person commissioned with the collection of the sample takes off his coat, turns up his shirt-sleeves on both arms, fastening them so securely that they cannot fall down of themselves. Then he washes his hands and arms most carefully with soap and brush to above the elbow-joint. Special care must be bestowed upon the cleansing of the finger-nails, which must if necessary be treated with the nail-file. Finally, the person in question dries himself with a clean towel."

We take it that the value of results depending upon manipulations carried out by persons requiring these instructions would be such that it would be no loss if they were dispensed with altogether. Indeed, unless the bacteriological examination of water be invariably carried out by qualified persons, and by them employed only in cases where it is really capable of rendering service, it is certain to fall into that disrepute which has so frequently been drawn down upon the chemical examination of water through incompetent analysts. Indeed the bacteriological method has already seriously suffered in public estimation through the contradictions which have resulted from the attempts made in some quarters to classify waters according to the number of microbes revealed on cultivation. Such arbitrary standards have already done much mischief in the case of the chemical analysis of water; in the bacteriological examination they are still more reprehensible, and it is deeply to be regretted that Dr. Miquel, in this most recent work on the subject, should seek to perpetuate a system of standards which experience shows to be quite untenable.

The work concludes with some excellent recommendations as to the sterilization of water for drinking-purposes, a subject which cannot be too frequently brought into public notice, for, using Dr. Miquel's own words, "la vie d'un homme a bien sa valeur à côté du prix insignifiant auquel revient le litre d'eau purgée de germes qu'il peut consommer en vingt-quatre heures."

Percy F. Frankland.

EPIDEMIC INFLUENZA.

Epidemic Influenza: Notes on its Origin and Method of Spread. By Richard Sisley, M.D. (London: Longmans, Green, and Co., 1891.)

THE object of this brief treatise, which was prepared before the issue of the Report of the Local Government Board, is to prove the doctrine, widely held by physicians of eminence in the eighteenth century, that influenza is contagious, or, more strictly speaking, infectious, and therefore, in the opinion of the author, fit to be included among the diseases of which notification is locally compulsory. The book is somewhat peculiar in its arrangement, but in the essential qualities of impartiality and clearness leaves nothing to be desired. Many readers who do not require more than specimens of evidence, will thank Dr. Sisley for compressing the digest of "many thousands" of notes into such narrow compass; but other minds will require a chain of which every link is massive, to guide them to the point of view whence practical conclusions are palpable. If the manner of statement is somewhat bare, and examples rather scanty, in the exposition of a strong but disputed case, the facts brought forward bear none the less value in their neutral setting, and go far to justify the proposition with which he confronts us at the outset, derived from a study of the distribution of the disease and from its pathological character. Valuable assistance from Dr. Klein, Prof. Fleming, and many others, has enabled him to include in his pages some interesting matter relating to the microbic nature of the epidemic and its relation to a similar disease in animals. After all that has been conjectured on the latter point, it appears that evidence of any unusual prevalence of influenza among animals at the time is still wanting.

The original seat of influenza, which has been obscurely indicated in previous times as lying somewhere "in the East," has now been discerned in Mongolian and Chinese territory, for we have two independent accounts, each speaking of influenza as not uncommon in some parts of China. In Mongolia "it seldom proves fatal, but travellers are careful to avoid it, and no one would think of using the pot or ladle of a family suffering from this sickness." If the disease is sporadic and endemic in these countries, the population may be to some degree protected against epidemic outbreaks, for we have seen in Europe that the tendency to spread is much less marked in a second invasion occurring within one year, and least, on the whole, in those places where it was previously most severe.

The notes from Bokhara, translated in this volume, are of great importance, for they show how a wet spring had turned the neighbouring country into a perfect marsh, from which, when the hot weather set in, poisonous exhalations were given forth, and how the people, crowded together with horses, cattle, and sheep between high walls, distressed and weak with starvation and disease, were attacked much earlier than usual, in the first heat of summer, with malaria, and how this was quickly followed by an epidemic of influenza, reaching its height in July 1889. The extension of the disease westwards from Bokhara by the flight of convalescents to Russia, and eastwards by caravans to post-stations in Siberia, has been noticed in the official Report, and completes the evidence connecting the European epidemic with the miserable condition of an Asiatic town. Upon such a soil, influenza sprang into fatal activity, and acquired, as we may fairly infer, a particular virulence. In similar conditions, amid the filth, floods, and famines of Asiatic countries, cholera and other plagues of men and animals have been evolved and have set forth on their destructive march.

By reports from several medical officers, and by a number of charts showing the curve of prevalence of the disease in English and foreign cities, Dr. Sisley shows that we have no experience of any sudden prostration of a large population within a few days, such as was formerly supposed to occur; but that the rise is always gradual from a few cases to hundreds and thousands, the maximum usually occurring from one to two months after the first cases in the locality have been noted. Last century Dr. Haygarth had been fortunate in discovering the person who brought the infection to each place in his district. If equal pains had been taken in 1890, when the disease was on its way to us from Russia, the persons who conveyed it from country to country might, no doubt, have been identified. The author has not been able to find a single instance in which there was a sudden infection of a large number of people without the previous existence of cases of the disease; and wherever its course was studied with care, it was seen to spread in the same way as other infectious diseases. But the "atmospheric" doctrine, though previously disproved with regard to rabies, cholera, and pestilence in general, still finds a stronghold in consumption and influenza.

The classic examples of ships supposed to have been attacked on the ocean by wind-borne influenza, as well as those of towns supposed to have been prostrated "in a single day," really bear testimony to the insidious growth of the disease and to the necessity of early recognition. Neither in this volume nor in others on the same subject is the fact sufficiently dwelt upon, that the geographical distribution of this and of previous epidemics in successive weeks and months was wholly unlike what would have occurred if the germs had been largely spread, either by lower or by upper atmospheric currents.

The total exemption of lighthouse-keepers, deep-sea fishermen, and unvisited islands, is scarcely noticed by Dr. Sisley, but he considers the rarity of influenza among prisoners to have been due to their removal from sources of contagion, and relates a very interesting case of apparent infection of a man on his way home from a light-ship through contact with the crew of a fishing-boat, said to be in good health.

Dr. Sisley concludes that there is no convincing proof of transmission through unaffected persons, letters, &c.; but a series of cases each of considerable weight surely amounts to evidence strong enough to justify some precautions, such as would be taken with the organic dust from more serious diseases, *e.g.* scarlet fever and diphtheria, which are so transmissible. There is happily a great deal in common in the mode of spread of most zymotic diseases, and disinfection as usually practised could hardly be misapplied to influenza. The same may be said with regard to isolation, for no attack, however trivial in itself, is a matter of indifference to the public, if it may result in widespread illness, loss of work, and distress. A short retirement is desirable in the interest both of the patient and of the public. But Dr. Sisley can hardly desire that notification should take place on exactly the same lines as that of other diseases, for local authorities would with reason wince at the expense; and unless the notification were a national undertaking, no district would be adequately protected thereby from imported cases. Complete and national measures of notification and isolation, with the co-operation of local authorities, would be much more likely to be effectual. An expenditure of one-fiftieth of the cost of the recent epidemic would probably secure the country from any such infliction in future. But we must admit that without a somewhat strict supervision at ports of entry during the period of prevalence in other countries, and without provision for the segregation of slight or suspected cases during that period, mere notification would not be likely to put a stop to the spread of influenza. The early cases are worth taking a great deal of trouble to discover and isolate. When once many cases have occurred in a locality, the further progress of so protean a disease is difficult to arrest. The best chance of averting an epidemic must be sought in scrupulous care for early isolation, in tracing the movements of travellers from infected towns, and in the increased practice of ventilation in private houses and in public gatherings. Like typhus, influenza seems incapable of inflicting much damage except through the medium of close, confined, and impure air, and where measures of isolation and disinfection are used it seldom spreads. But the infectious character of influenza must be internationally recognized before protective regulations can achieve a full measure of success.

R. RUSSELL.

GENERAL CHEMICAL MINERALOGY.

Allgemeine Chemische Mineralogie. Von Dr. C. Doelter, O. Professor der Mineralogie an der K. K. Universität Graz. With 14 Figures in the Text. (Leipzig: W. Engelmann, 1890.)

MINERALOGY, at first purely descriptive, has been raised to the dignity of an experimental science by the application of the principles of chemistry and physics. The writer of a mineralogical text-book is thus met at the outset with the difficulty of deciding what amount of knowledge of chemistry and physics to assume in his reader. With regard to the chemical side at least, the rule appears to be to assume that he knows very little, and yet, somewhat inconsistently, to make the exposition of the atomic theory and the fundamental principles of chemistry so brief as to be of little service to one who has had no previous acquaintance with the subject.

The author of the present, in many respects useful and suggestive, book follows the same lines. The whole account of the fundamental chemical theories occupies about ten pages of the introduction. The same fault will be found in other parts of the book: *e.g.* it would be difficult to say to what class of reader a large portion of the chapter on chemical analysis would be useful. In his endeavour to introduce as many extracts as possible from the current literature of the subject, the author allows himself in many places to become somewhat sketchy. In spite of this, the book, with its wealth of information upon points which have not hitherto found a place in ordinary mineralogical text-books, will be found to give a very good idea of the present state of mineralogical science from a chemical point of view.

The arrangement of the book is in seven sections, viz. (1) introduction; (2) chemical crystallography; (3) chemical analysis of minerals; (4) synthesis of minerals; (5) metamorphism of minerals; (6) formation of minerals in nature; (7) chemical composition and constitution of minerals.

In the introduction, containing an account of the atomic theory and its consequences, one or two suggestive ideas will be found: *e.g.* the correspondence, pointed out by Tschermak, between the chemical law of multiple proportions and the crystallographic law of simple parameter ratios; and also the analogy between the law of constant proportion by weight and the fundamental crystallographic law of constancy of angle. The subject of chemical crystallography receives very full treatment. Here the reader is initiated into the mysteries of chemical and physical isomerism, polymorphism, enantiotropy, isomorphism, isodimorphism, isogonism, morphotropy, &c.; and if the perusal of this section, as well as of the last, on the constitution of minerals, shall leave him with a rather confused and unfavourable idea of the subject, the fault should perhaps be rather attributed to the present imperfect state of our knowledge than to the author. At present it is in most cases impossible to say whether bodies are polymeric, metameric, or chemical isomers.

As regards isomorphism, if the formation of mixed crystals is to remain the test, the original definition of Mitscherlich must be modified to suit the fact of the formation of mixed crystals from compounds of not precisely analogous chemical composition. Thus, according to modern views, isomorphism is in some degree to be deposed from its proud position as an infallible guide to chemical composition. The insidious nature of the attack upon this ancient stronghold of the faith may be judged by a comparison of one of the latest definitions of isomorphism with the original definition of Mitscherlich. According to the latter, isomorphism is the power which two or more compounds of *analogous* chemical composition possess of crystallizing in the same or similar crystalline forms, and of mixing in varying proportions to form homogeneous crystals. The latest definition is that bodies are isomorphous which, with *for the most part similar* chemical composition, possess the property of crystallizing in similar crystalline forms, and of forming mixed crystals which morphologically and physically graduate into each other. Such a change it is expected would lead to a considerable simplification in many of the formulæ which have been made unnecessarily complicated in order to comply with the requirements of Mitscherlich's definition.

The section on chemical analysis of minerals is one of the least satisfactory in the book. Short summaries of analytical methods can be of little service to any class of reader. Amongst matter which will not be generally found in the ordinary chemical text-book, this section contains some account of microchemical reactions, of the methods for the mechanical separation of minerals, so as to insure pure material for analysis, and directions for the course of analysis to be pursued in the case of the more important minerals.

The important subject of mineral synthesis receives more complete treatment than any other in the book. The section contains general accounts of the various methods for the artificial production of minerals by chemical reactions, fusion, sublimation, electrolysis, diffusion, &c., with detailed descriptions of the apparatus required.